Feb. 27, 1962 J. VAN ROOJEN 3,022,680

INCREMENTAL FEED MECHANISM

Filed July 18, 1960 2 Sheets-Sheet 1

Fig. 1

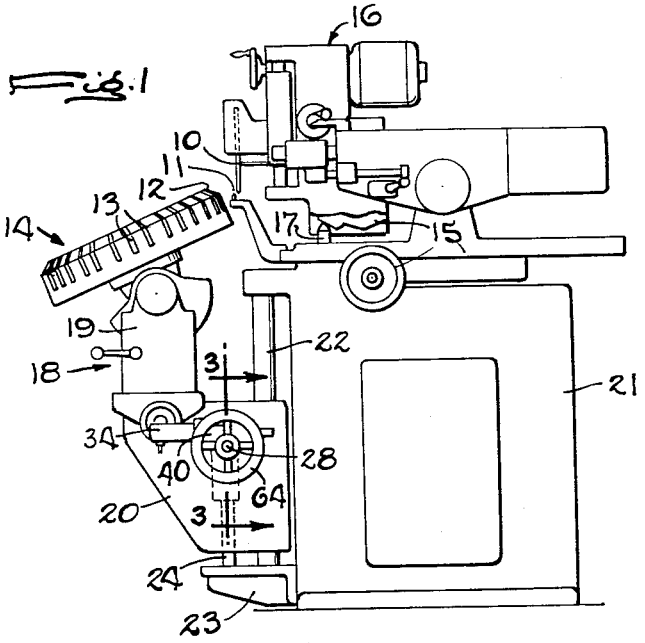
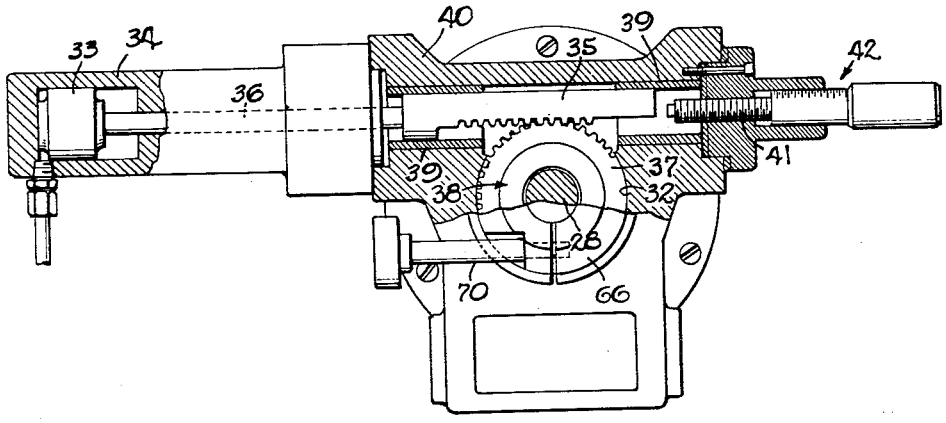


Fig. 2



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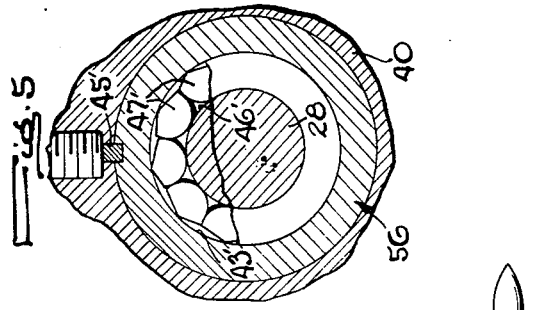

Fig. 5

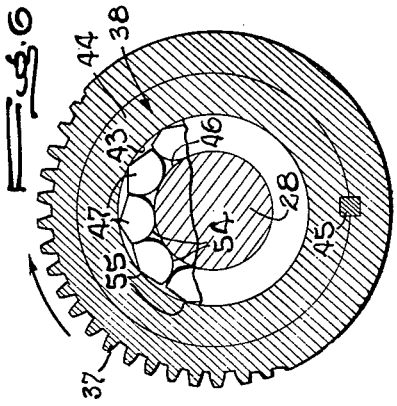

Fig. 6

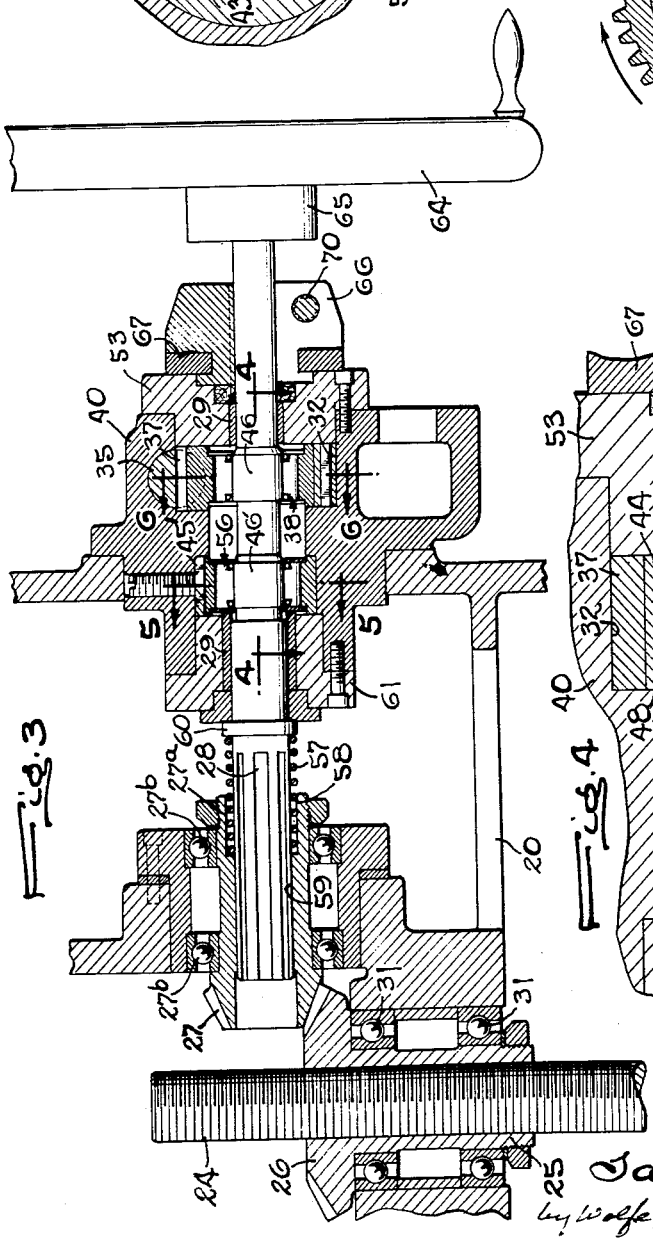

Fig. 3

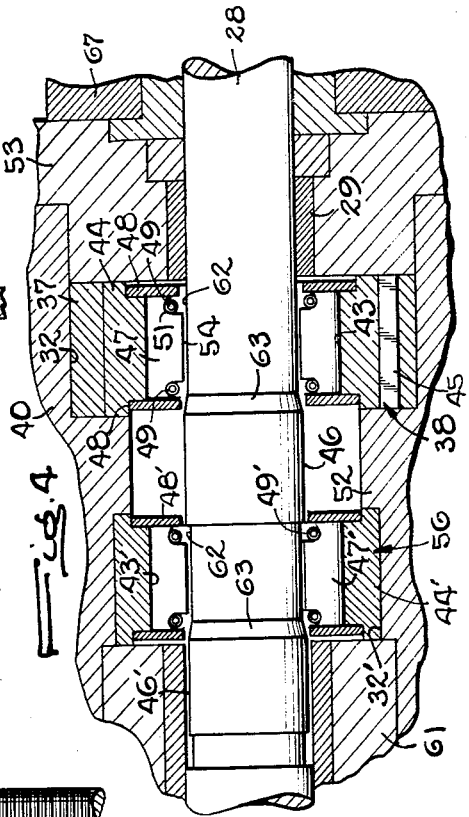

Fig. 4

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INCREMENTAL FEED MECHANISM

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Filed July 18, 1960, Ser. No. 43,432
2 Claims. (Cl. 74—625)

This invention relates generally to a mechanism for converting the reciprocatory motion of a power actuator into a unidirectional motion of a driven part to advance the latter in successive steps of equal lengths while providing for independent manual adjustment of the driven part to establish a selected starting point for the step-by-step movement. More particularly, the driven part is indexed or advanced step-by-step by a means comprising a one-way clutch of the instantly engaging type and its positions are retained by a similar unit acting as a brake during the retracting strokes of the actuator.

The general object is to provide a mechanism of the above character which, as compared to prior devices, is simpler and more economical in construction and capable of being indexed in a greater number of steps.

A more specific object is to take advantage of an inherent but seldom used characteristic of the instantly engageable clutches and brakes to permit manual disengagement of the power feed, independent manual movement of the driven part, and re-engagement of the feed with virtually no movement of the driven part during uncoupling and recoupling.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which—

FIGURE 1 is a fragmentary side elevational view of a cutter sharpener incorporating an incremental feed mechanism embodying the novel features of the present invention.

FIG. 2 is a fragmentary vertical section of the reciprocating actuator.

FIG. 3 is a fragmnetary section taken along the line 3—3 of FIG. 1.

FIG. 4 is a somewhat enlarged fragmentary section taken along the line 4—4 of FIG. 3 showing another position of the driven shaft.

FIGS. 5 and 6 are fragmentary sections taken respectively along the lines 5—5 and 6—6 of FIG. 3.

For purposes of illustration, the invention is shown in the drawings embodied in a grinding machine in which a power rotated abrasive wheel **10** is reciprocated in a generally horizontal path back and forth across a dressing point **11** and the work surface to be ground, in this case the edge **12** of a blade **13** on a cutter **14**. Contouring of the wheel **10** by the dressing point and following the contour of the blade edge are controlled by a cam **15** on the wheel head **16** riding along a stationary follower **17**.

The cutter **14** is held in a fixture **18** including a support **19** and a carrier **20** and is indexable relative to the fixture to position successive cutter blades for the grinding operation. Slidably mounting the carrier **20** on the machine base **21** for vertical step-by-step movement are guide bars **22** fixed at their upper ends to the machine base and at their lower ends to a bracket **23** on the base. A screw **24** (FIG. 3) fixed to and upstanding from the bracket threads through a nut **25** forming the hub of a bevel gear **26**. The nut is journaled in a thrust bearing **31** in the carrier **20**. The gear meshes with a bevel gear **27** on a sleeve **27a** journaled in bearings **27b** and internally splined to receive mating spline teeth on the end of a horizontal shaft **28**. The latter is journaled in bearings **29** in the carrier **20**. Turning the shaft in opposite directions rotates the nut thereby raising and lowering the carrier **20** along the guide bars and the screw.

Intermittent turning of the shaft **28** to feed the carrier upwardly step by step is effected by a reciprocating actuator mounted in a housing **40** and comprising a cylinder **34** and a piston **33** slidable back and forth therein in response to the admission of pressure alternately into opposite ends of the cylinder. The outer end of the piston rod **36** carries a rack **35** guided in bearings **39** in the carrier **20** and meshed with a mutilated pinion **37**. Formed between the inner wall of the carrier and a retaining end plate **53** encircling the shaft **28** is a groove **32** in which the pinion is journaled loosely around its outer periphery and located axially between the inner side wall of the groove and the plate.

The piston **33** and rack bar **35** reciprocate back and forth between stops, one provided by the head end of the cylinder **34**. The other stop is a screw **41** threaded into the actuator housing and adjustable by a micrometer **42** to determine the length of the forward stroke of the rack.

The means herein shown for coupling the pinion **37** to the shaft **28** during the forward strokes of the rack comprises a one-way driving clutch **38** of the Morse so-called Series 200 type. It includes a cylindrical outer race **43** (FIG. 6) formed by the inner periphery of a ring **44** concentric with and telescoped in the bore of the pinion **37** and held rigidly therewith by a key **45**. The cylindrical inner race **46** of the clutch is formed directly on the shaft **28** concentric with the axis thereof. Eccentric cams or wedges **47** for gripping the races are arranged in an annular series between the latter and are positioned axially between two retaining rings **48** pressed into counter-bores at opposite ends of the ring **44**. Garter springs **49** seated in notches **51** in the ends of the wedges hold the wedges against the outer race **43**. The wedges are tiltable, roller-like elements having an arcuate rolling surface **54** bearing on the inner race **46** and an eccentrically disposed outer edge **55** engageable with the outer race. The effective thickness is greater than the spacing of the inner and outer races so that upon turning of the outer ring in one direction, clockwise as shown in FIG. 6, the wedges are rocked to press their inner arcuate surfaces into gripping engagement with the inner race and thereby immediately lock the two rings together for turning in unison during the entire stroke of the rack bar. At the beginning of the return stroke, the wedges are rocked reversely releasing the gripping pressure so as to free the outer race for turning independently of the shaft **28**.

A similar but reversely acting unit **56** (FIG. 5) is spaced axially along the shaft **28** from the driving coupling **38** and operates as a feed backstop brake effective to grip the shaft and prevent counter-rotation thereof during return strokes of the piston **33** while releasing the shaft during the forward strokes. In this unit, the outer race ring **44'** is seated in a groove **32'** formed between the inner carrier wall **52** and a retaining end plate **61** and is secured to the carrier **20** by a key **45'**. As before, the inner race **46'** is formed directly on the shaft concentric with the axis thereof. Since the outer race is fixed, however, the brake is disengaged during rotation of the shaft by the driving clutch **38**, engages to prevent reverse turning during the return stroke of the piston, and disengages when the next forward stroke begins.

Clutches and brakes of the character above described may be said to be instantly engageable. That is to say, the surfaces of the wedge elements of the driving clutch grip the inner and outer races instantly, with virtually no loss of motion, upon turning of the outer race ring

in the driving direction. Similarly, the release of the clutch takes place instantly upon the reverse turning of the outer race ring. I have discovered that, with the wedge elements mounted as above described, the inner races and the supporting shaft may be inserted in and removed from the clutch and the brake without the necessity of noticeable turning of the shaft to effect proper re-engagement of the inner races and the wedges.

The invention contemplates utilizing this unique characteristic of instantly engageable one-way clutches and brakes to enable the clutch **38** and brake **56** to be disengaged simultaneously simply by axially shifting the driven shaft **28** to carry the two inner races out of association with their respective wedge elements. This permits the shaft to be turned independently of the power actuator for manual movement of the actuated device or cutter mounting to adjust the same to a new desired position. Similarly, by reverse shifting of the shaft, the inner races are brought back into the planes of their wedges, thus reconditioning the clutch and the brake for ratcheting of the shaft by the power actuator.

During automatic operation, the shaft is held by a helical spring **57** against axial movement out of the position wherein the inner races are disposed in the planes of the respective wedge elements, as shown in FIG. 3. The spring is seated in the counter-bore **58** around the splined bore **59** and acts in compression against an annular shoulder **60** rigid with and encircling the shaft **28**, and bearing against the end plate **61**.

To permit disabling of the clutch and the brake by axial shifting of the shaft, surfaces **62** on the shaft **28** adjacent the races **46**, **46'** are of slightly reduced diameter, in this instance about .056 of an inch smaller than the races. This is shown on an exaggerated scale in FIG. 4. When the shaft is shifted to the left out of the driving position shown in FIG. 3 into the disengaged position shown in FIG. 4, the reduced diameter surfaces become disposed in the planes of the respective wedges, and both the clutch and the brake are disabled. The extent of the shifting is somewhat greater than the axial length of the inner races so that the latter are carried completely out of engagement with the wedges, such shifting being permitted by compression of the spring **57**.

The inner races and the surfaces **62** of reduced diameter are spaced a short distance apart axially and joined by frusto-conical surfaces **63** which serve as guides to facilitate re-entry of the races into proper relation with the wedge elements as the shaft **28** is shifted reversely to effect re-engagement of the races and the wedge elements.

Back and forth shifting of the shaft and turning thereof while the clutch **38** and the brake **56** are disengaged (FIG. 4) may be accomplished conveniently by a hand wheel **64** fixed to the outwardly projecting end of the shaft and having a hub **65** which is adapted for abutment with a collar **66** to limit the inward shifting and thereby locate the races **46**, **46'** out of the planes of the respective wedges. The collar is split and adapted to grip the shaft **28** upon manual actuation of a suitable screw clamp **70**. It is journaled in a ring **67** fixed to the outer end of the retaining plate **53**.

When it is desired to change the position of the cutter mounting independently of the power actuator, the operator grasps the wheel **64** and pushes it inwardly against the action of the spring **57** until the hub **65** comes against the collar **66**. Both the clutch and the brake are thus disengaged and the position of the shaft may be retained by tightening the clamp **70**. Then, by turning the hand wheel, the cutter mounting may be lowered for the purpose of changing cutters and again raised to a desired position.

It will be apparent that the power actuator or the manual adjuster may be conditioned selectively for individual operation simply by back and forth shifting of the shaft **28** which is a common element of both drives. Moreover, the structure required for such changes is exceedingly simple involving as it does only the mounting of the shaft for axial shifting and the formation of the reduced diameter surfaces thereon.

I claim as my invention:

1. The combination of a shaft, means supporting said shaft for turning about a fixed axis and also for axial sliding, an actuating member reciprocable back and forth through forward and return strokes, means for converting the successive forward strokes of said member into unidirectional step-by-step turning of said shaft comprising an instantly engageable one-way clutch encircling the shaft and comprising an annular series of cams and concentric inner and outer races between which said cams become wedged upon relative turning of the races in one direction, said inner race being cylindrical and rigid with the shaft and concentric with said axis, a similar instantly engageable unit forming a brake for holding said shaft against reverse turning during and after the return strokes of said member and having a cylindrical inner race rigid with said shaft and spaced axially from said first race, the surfaces of said shaft adjacent said inner races being smaller in diameter than the races, and manually operable means for shifting said shaft back and forth axially between two predetermined positions in one of which both of said races are located for gripping engagement with the respective cams, said reduced diameter surfaces on said shaft being disposed in the planes of the respective cams in the other of said positions whereby to disable the clutch and the brake and permit turning of said shaft independently of said reciprocable member.

2. The combination of a shaft, means supporting said shaft for turning about a fixed axis and also for axial sliding, an actuating member reciprocable back and forth through forward and return strokes, means for converting the successive forward strokes of said member into unidirectional step-by-step turning of said shaft comprising an instantly engageable one-way clutch encircling the shaft and comprising an annular series of cams and concentric inner and outer races between which said cams become wedged upon relative turning of the races in one direction, said inner race being cylindrical and rigid with the shaft and concentric with said axis, a similar instantly engageable unit forming a brake for holding said shaft against reverse turning during the return strokes of said member and having a cylindrical inner race rigid with said shaft and spaced axially from said first race, the surfaces of said shaft adjacent said inner races being smaller in diameter than the races, and manually operable means for shifting said shaft back and forth axially to carry both of said inner races into and out of location for gripping engagement with said cams and thereby respectively engage and disengage both said clutch and said brake, said shaft having frustro-conical surfaces between the inner races and said smaller diameter surfaces to facilitate re-entry of the inner races into engagement with said cams.

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